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# Festivals of science and the two cultures: science, design and display in the Festival of Britain, 1951

SOPHIE FORGAN*

> We shall make pictures, when we have the skill,
> Of the clear crystals that these rocks distill,
> And draw fair patterns to enrich our sight
> With the inexorable curves of light.
> We shall weave tapestries as fine as lace
> Of the minute events of time in space.
>
> Winifred Holtby[1]

National exhibitions and festivals perform a number of roles at the same time. In the first half of the twentieth century exhibitions were first and foremost trade fairs, occasions on which to promote British goods but at the same time provide an opportunity for cementing imperial relations. Exhibitions are also sites of aesthetic discourse where, for example, particular architectural or design ideologies may be promoted; in addition, they provide platforms for the conspicuous display of scientific and technical achievement; and finally, they provide opportunities for creating and projecting ideas of national identity, however multi-faceted those might be. Furthermore, in order to encourage the widest possible attendance and popularity, most exhibitions from the late nineteenth century onwards included a large number of purely entertaining attractions, which of course provided places for the mingling of social classes, something that appealed to post-1945 notions of a properly democratic society. Exhibitions therefore always perform a number of functions, some of which may indeed conflict with each other, and need to be analysed on a number of levels.[2]

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I am grateful to the many people who have given me information or reminiscences about the Festival and to the audiences where earlier versions of this paper were presented. Particular thanks for their help are due to Helen Megaw, who kindly gave me her recollections of the Festival Pattern Group, and to Helen Clifford, Paul Denison, David Edgerton, Graeme Gooday, Colin Hempstead, Alan Irvine, Xerxes Mazda, Mary Schoesser and Barbara Usherwood and the guest editors of this special issue, J. V. Field and Frank James. I am grateful to Catherine Moriarty of the Design Council Archive at the University of Brighton for help in locating images and permission to reproduce several of the pictures included here; and to the National Archive of Art and Design for permission to quote the papers of Dr Helen Megaw and providing photographs of the drawings reproduced in Figures 3–5.

1 Winifred Holtby (1898–1935), writer, critic and feminist. Copy in the hand of Helen Megaw, crystallographer, and used by her as preface to the draft of an article, 'Pattern in crystallography', written around 1946 but not published in that form; Helen Megaw's Papers, mainly relating to the Crystal Design Project of the Festival of Britain, Festival Pattern Group, Victoria & Albert Museum Archive of Art and Design, London, 3/36-1977 (hereafter Megaw Papers AAD).

2 A useful introduction may be found in P. Greenhalgh, *The Expositions Universelles: Great Exhibitions and World's Fairs, 1851–1939*, Manchester, 1988.

The Festival of Britain, held in 1951, may be studied on all these accounts. Although frequently mentioned in contemporary histories, and still within the living memory of many people, it is, however, an episode that has been neglected by historians of science. Yet it was one of the most impressive displays of science and technology the country had yet seen, and the two symbols that are still most readily associated with it, the Skylon and the Dome of Discovery, were structures that embodied ideas about science and its centrality to the country's welfare and future. The Festival illuminates many of the problems associated with the study of popular science and the popularization of science and how such phenomena might be analysed.[3] If the focus is 'science *in* culture', this has the disadvantage of treating culture as a separate and essentially non-scientific entity with which science may or may not be associated, and thus subscribes at the outset to a rhetoric of the 'two cultures'. On the other hand, to examine 'science *as* culture' avoids the former problem, and allows one to treat science in the same way as other common forms of communication, situated in particular cultures and ideologies, as many studies in the sociology of science have done. The visual rhetoric employed, the magic of display, the construction of particular scientific narratives in the midst of other narratives, and even to some extent their reception by the audience, can then be investigated. Clearly there is in the Festival of Britain an opportunity to examine the social construction of public representations of science and ask how important this particular moment was in forming post-war images of science.

General ideas and images about the Festival have inevitably been shaped by its historiography, which has largely been written by historians of the arts and design. A retrospective exhibition was held in 1976 at the Victoria & Albert Museum in London and the volume published at the same time helped to fix interpretations of the Festival for the next two decades.[4] There has also been continuing interest in the use of scientific motifs for modern ornamental patterns. References to the Festival's optimistic visions of science and technology form part of many texts on post-war art and design.[5] However, the main emphasis of these works is naturally on design and, to a lesser extent, on architecture. The Festival indeed is regarded by some historians as a key moment in setting the agenda for the architectural, design and planning professions in post-war Britain. Science has been by comparison neglected. I would argue that the role of science in the Festival was far more significant and pervasive than has hitherto been acknowledged. In this respect my argument relates to David Edgerton's revisionist history, which questions the widely accepted notion of British industrial 'decline' brought about by neglect of science and technology.[6] In 1951 science was far from neglected and was embedded in virtually every aspect of the Festival. A large number of scientists were involved, both directly and indirectly, in its planning and execution. Techniques of display for scientific exhibits were selected with the greatest of care. It was the first large post-war display of science in a

3 R. Cooter and S. Pumfrey, 'Separate spheres and public places: reflections on the history of science popularization and science in popular culture', *History of Science* (1994), **32**, 237–67.

4 M. Banham and B. Hillier (eds.), *Tonic to the Nation*, London, 1976. This remains, however, a very useful source of information about the Festival and of retrospective memories of it.

5 For example, J. Woodham, *Twentieth Century Ornament*, London, 1990, 203–5; L. Jackson, *The New Look: Design in the Fifties*, London, 1991, 85–94.

6 D. Edgerton, *Science, Technology and the British Industrial 'Decline' 1870–1970*, Cambridge, 1996.

public exhibition, and consciously harnessed the visual language of the time to the presentation and promotion of science. If indeed science was so pervasive, the key problem then is to account for its absence in later accounts. Why has science been generally written out of the Festival's history, and largely expunged from the historical account of that moment which was most influential in moulding its post-war image?

This account can only touch on the last question, and there are large issues that relate to the articulation of ideas in this period immediately preceding the 'two cultures' debate. The debate appears to have emerged in these terms first in 1956, when C. P. Snow (1905–80) wrote an article thus entitled in the *New Statesman*, and then in full blown form as a result of his Rede Lecture in Cambridge of 1959.[7] The purpose of this paper is not to explore the issue of the 'two cultures' generally, but to explore the ways that ideas and images of science were constructed in the Festival. I will begin by outlining the necessary background of the organization and declared aims of the Festival, and then discuss the role of science in one project that deliberately tried to bring about a marriage between science and design – the Festival Pattern Group. The focus will then shift to the way that displays involving science were put together and what display techniques were used in the perennial search for clarity and appeal to a non-scientific audience.

## ORGANIZATION AND AIMS OF THE FESTIVAL

> The Festival is nation-wide. All through the summer, and all through the land, its spirit will be finding expression in a variety of British sights and a great range of British sounds. Taken together, these will add up to one united act of national reassessment, and one corporate reaffirmation of faith in the nation's future.
>
> Ian Cox[8]

The essential background to the Festival was the post-war Labour government and the creation of the welfare state. In the foreground were the new Councils and cultural bodies set up with the aim of revitalizing British life. The idea of a 1951 Festival was first mooted in 1943, but emerged as a definite proposition in 1947–48, in part to commemorate the centenary of the Great Exhibition of 1851, and in part to signal a relief from unparalleled austerity.[9] The headquarters were in the Treasury, not surprisingly given the economic strait-jacket of the period, with an Exhibition Unit set up in the Central Office for Information. In April 1949 the two were merged to form the Festival of Britain Office, with Gerald Barry appointed Director-General under the chairmanship of General Lord

7 C. P. Snow, 'The two cultures', *New Statesman*, 6 October 1956, 413; and *The Rede Lecture, 1959: The Two Cultures*, Cambridge, 1959. Although it was commonplace to talk about 'culture', it seems probable that it was Snow who coined the term 'two cultures', which has now become an inalterable part of the historiography of the period.

8 Ian Cox, *The South Bank Exhibition: A Guide to the Story it Tells*, London, 1951, 6. The guidebooks to the main exhibitions in the Festival were produced by the Festival Office and published by HMSO.

9 The Ramsden Report for the Board of Trade in 1943 considered 'the part which Exhibitions and Fairs should play in the promotion of Export Trade in the Post War Era'; cited in R. Stewart, *Design and British Industry*, London, 1987. On 22 August 1947 the then Director of the Science Museum, Dr Herman Shaw (1891–1950), wrote to Sir Evelyn Shaw about the possibility of having a big commemorative exhibition in 1951. In the background of course was the realization that an exhibition would hasten much needed reconstruction work on the Museum's bomb-damaged building; Science Museum Archive, London, 8390/1/1.

Ismay.[10] Associated with the Festival of Britain office were the Council of Industrial Design, the Arts Council (both recent government creations), together with the British Film Institute and the National Book League. In addition, two Councils were created, one for Architecture and the other for Science and Technology, as there were no comparable official bodies in existence for those areas. Initially it was proposed to hold a 'Combined Exhibition' on one site, together with a number of other exhibitions and events held across the country. However, it soon became clear that the Arts Council wanted to organize its own set of events, and that likewise the British Film Council was more interested in promoting new creative work than in contributing directly to the Combined Exhibition. In the event, the main bodies concerned with the South Bank Exhibition were the Science Council and the Council of Industrial Design. To add to the complications, the actual site of the main exhibition – the South Bank in London – was not decided till relatively late, by which time the theme had been decided and a lot of the planning had already been done as it were back to front.[11]

The role of the Science Council was advisory, and major bodies were invited to nominate members.[12] The Royal Society nominated its two secretaries, Sir Alfred Egerton (1886–1959) the chemist, and Sir Edward Salisbury (1886–1978) the botanist. Other members represented different areas – Sir John Fryer (1886–1948) was Secretary to the Agricultural Research Council; Sir Frank Smith (1876–1970), electrical engineer and former Secretary of the very important Department of Scientific and Industrial Research, was nominated by the Royal Society of Arts; Colonel Sir Stanley Angwin (1883–1959), chairman of one of Britain's major communication companies Cable and Wireless, and also of the Radio Research Board, was the nominee of the Institution of Electrical Engineers; there were two nominees from the Medical Research Council, and so on.[13] The chairman was Sir Alan Barlow (1881–1968), an eminent civil servant, and all had close connections with government or official scientific bodies.[14] It was therefore a very high powered body. In addition, eighteen specialist panels were assembled for each area of science to be displayed, comprising 156 members, the majority of whom were top-ranking scientists in their fields. The key figure in the whole structure was the Director for Science, Ian Cox (1910–90). Cox was by training a geologist, who had been on Arctic expeditions

10 Gerald Barry (1898–1968), Editor of the *News Chronicle* 1936–47, and Director-General of the Festival of Britain, 1948–51; General Lord 'Pug' Ismay (1887–1963) had had a distinguished military career and, as Roy Strong pointed out, his appointment was a masterstroke of practical politics, and was also symbolically 'in human terms, swords turned into ploughshares'; Banham and Hillier, op. cit. (4), 13.

11 Ian Cox, final Report to the Council for Science and Technology, 31 October 1951, p. 10; Public Record Office, Kew, WORKS 25/50/A5/F2 (hereafter PRO). Cox gives a briefer version of a good part of this report in 'Three years a-growing: recollections of the Festival before the turnstiles opened', in Banham and Hillier, op. cit. (4), 62–9.

12 There were fifteen members, of whom one died and three retired before the Festival was finally opened. Full list given in Cox, final Report, op. cit. (11), 2.

13 Egerton, Salisbury, Smith and Angwin all appear in the *DNB*; Sir John Fryer had spent most of his career in Ministry of Agriculture laboratories, *Who Was Who*, London, 1932, iv, 414.

14 Barlow's career in the civil service culminated in the position of joint second secretary to the Treasury 1938–48. He had chaired the Barlow Committee set up to consider post-war policy on the use and development of Britain's scientific manpower resources. He was married to a granddaughter of Charles Darwin and known for his wide-ranging interests in both scientific and artistic affairs; *DNB*.

before the war, and then worked as a science programmer for the BBC and as science correspondent for the London Press Service.[15] He therefore had a desirable combination of scientific training and expertise together with experience of mass communication. Cox prepared memos for meetings of the Science Council, oversaw the implementation of the scientific exhibits and organized a team of eleven scientific officers to work with the display designers on the one hand and with the specialist scientific panels on the other.

What sort of exhibition was the Festival of Britain? It was *not* an exhibition in the pre-war mould, which tended to comprise palaces of power and halls of industry with attendant entertaining attractions. Instead it was a themed exhibition that presented a general narrative and guided visitors carefully along a planned route. The theming of an exhibition was in itself novel, particularly when the theme spanned several pavilions in a coherent manner, and the organizers were determined that the exhibition should not turn into a gigantic industrial fair, similar to the Great Exhibition whose centenary it commemorated. The narrative therefore centred around the twin themes of the land and the people of Britain. As the guidebook to the South Bank Exhibition enthused, Britain was endowed with land, scenery, climate and resources more varied than any country of similar size, had nurtured and challenged its people, who could not when taken together, be mistaken for any other nation in the world.[16] Building upon this theme, bringing together the land and its people, was the celebration of the achievement of British men and women in mapping and charting the globe, in exploring the heavens, and in investigating the structure and nature of the universe. Thus the extraordinary and ordinary were neatly juxtaposed. In addition, the exhibition was intended to be widely appealing, and also to be fun, to provide a blaze of light and colour, to cheer people up, and indeed it is famous for celebrating the peculiarities of the British sense of humour.[17] Beyond these worthy and appealing aims was the general desire on the one hand to promote British science and technology with a keen sense of pride in the achievements of British scientists and, on the other, to promote British goods and propagate ideas about the need for good design, particularly in those goods destined for export. The need to earn foreign currency was a constant anxiety. A means to bring science and 'well-designed' goods together found expression above all in the Festival Pattern Group project.

## THE FESTIVAL PATTERN GROUP

> The fact that the proposal to use these patterns as a source for decoration came from the scientific side, and has been taken up by artists working in industry, is a happy augury for the rebirth of an understanding between scientists and artists which many of us are hoping to see.
>
> Mark Hartland Thomas[18]

The desire of many of those working in the Festival Office, and of Gordon Russell of the

15 Ian Cox was also a member of the general Executive Committee and of the Presentations Panel, so a key figure in the general direction of the Festival.

16 Cox, op. cit. (8), 8–9.

17 This was given free rein in the Lion and the Unicorn pavilion, with a section devoted to British eccentricities and humours, and in the Battersea Pleasure Gardens with Rowland Emett's 'Far Tottering and Oyster Creek Railway'; see Banham and Hillier, op. cit. (4), 96–101, 125–7.

18 Mark Hartland Thomas to Sir Lawrence Bragg, 18 May 1951, Royal Institution Archives, London, Bragg MS, 50B/157.

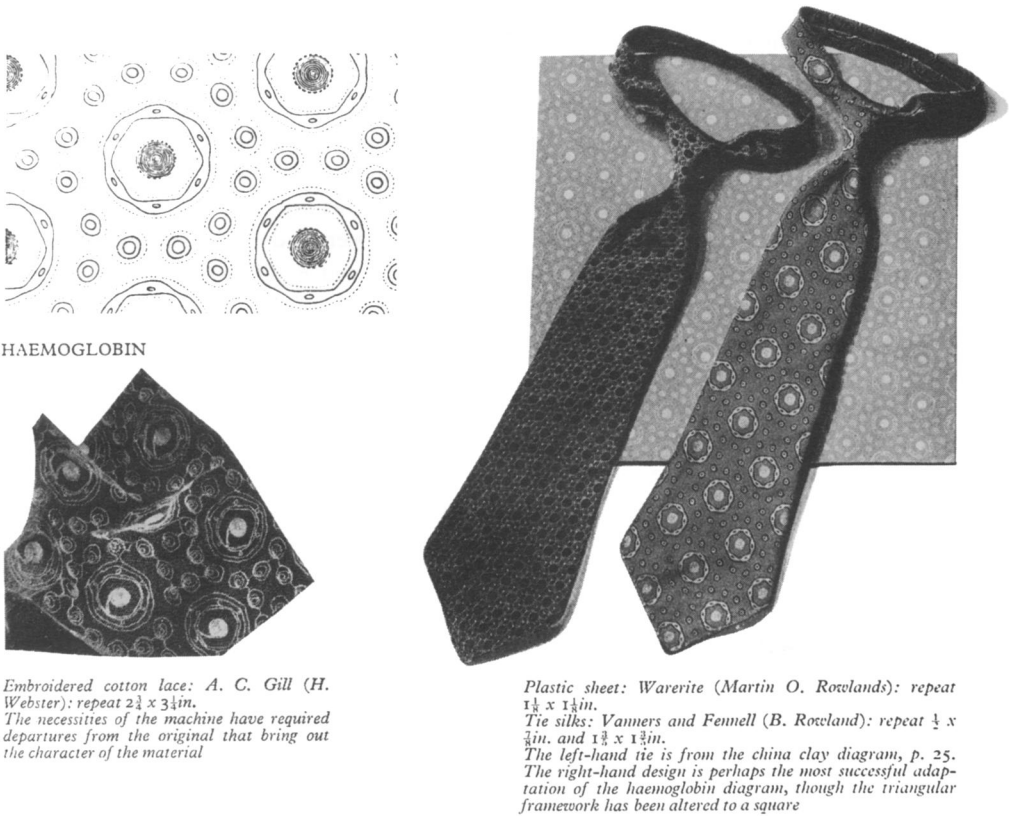



**Figure 1.** *Haemoglobin*: one of the most successful and widely used patterns, showing cotton lace, plastic sheeting and two ties, one of which is based, as noted, on a china clay pattern. The fabrics were designed in a number of different colourways. As illustrated in the *Souvenir Book of Crystal Designs: The Fascinating Story in Colour of the Festival Pattern Group*, London, 1951, 3. The *Souvenir Book* was careful to illustrate an example of the original crystal pattern alongside samples of the various products it had been made up into. Reproduced by kind permission of the Design Council/DHRC, University of Brighton.

Council of Industrial Design, to see science and design (in both its functional and its aesthetic sense) working together in a harmonious way was exemplified most clearly in the activities of the Festival Pattern Group. In brief, this was a move to use patterns derived from crystallographic structures as the basis for repetitive patterns in mass-produced consumer products, such as carpets, textiles, glassware or lighting. However, the project was bedevilled by conflicting aims, commercial concerns, problems of communication and a lack of mutual understanding of the differing creative processes of scientists and designers. As the project raises many questions relating on the one hand to scientific legitimacy and on the other to artistic conventions, it is necessary to describe it in some detail.

The background to the group was, first, the concern to promote British goods, especially those that it was felt reflected the Council of Industrial Design's nostrums on 'good design'

and might be destined for export.[19] Secondly, interest in science was widespread and characteristic of the time, particularly in areas of notable success, and Britain was at the forefront of research in crystallography. Such interest is exemplified in the extraordinarily apposite verse by Winifred Holtby cited at the head of this paper. The artistic intelligentsia showed considerable interest in science, which was in one respect a common feature of the adoption of Modernist principles (whether in the avant-garde arts or in more general philosophical terms), but also reflected a post-war utopianism and enthusiasm for exciting ideas to help build a better world. As early as July 1945, the Design Research Unit, run by Misha Black,[20] had contacted the Cambridge crystallographer Dr Helen Megaw,[21] asking for suggestions that took a 'daring' look at the future. In response, she suggested that the patterns that crop up in the course of crystallographic work could be used as basis for fabric pattern design.[22] The matter did not progress far until Kathleen Lonsdale (1903–71) borrowed some of the patterns drawn up by Helen Megaw for use in a lunchtime lecture on crystallography at University College London to a general audience.[23] Lonsdale was also concerned with bringing science (and ethical questions connected with science) to a wider audience and, according to one source, after hearing one of these lectures it was suggested to Norbert Dutton of the Society of Industrial Artists that she should be invited to address a weekend designers' course at Ashridge in May 1949.[24] Among the audience was Mark Hartland Thomas of the Council of Industrial Design, an engineer by training and responsible for the representation of industry at the Festival. Crystallography, the science of the moment and a tool to help understand the fundamental laws of matter, seemed to present the perfect opportunity to bring science and art together in the service of British industry and in celebration of British science.

Hartland Thomas then persuaded Helen Megaw to produce a range of drawings showing different crystal structures, and organized the setting up of the Festival Pattern Group, which eventually contained twenty-eight manufacturers of different goods, mostly those involving flat pattern design such as textiles and lace, but also a few china and glass manufacturers.[25] The Group met regularly from December 1949, with Megaw present at

19 For a discussion of the background to the concerns of the Council of Industrial Design, see Paddy Maguire, 'Designs on reconstruction: British business, market structures and the role of design in post-war recovery', *Journal of Design History* (1991), **4**, 15–30.

20 Misha Black (1910–77), industrial designer and founding partner of the Design Research Unit, which was headed initially by Herbert Read (1893–1968), the influential writer and art critic. The Design Research Unit was to become one of the most important design practices in post-war Britain.

21 Dr Helen Megaw (1907–), crystallographer, was a fellow of Girton College and Assistant Director of Research, Department of Physics, Cavendish Laboratory, University of Cambridge.

22 Letters between Marcus Brumwell (Design Research Unit) and Helen Megaw, 11 July 1945 to 25 November 1946, in Megaw Papers AAD, 3/8 to 15-1977. Marcus Brumwell was a friend of J. D. Bernal (1901–71), whose circle of crystallographic, artistic and radical friends so often appear in this period.

23 K. Lonsdale to H. Megaw, 16 November 1946, Megaw Papers AAD, 3/28-1977. The title was apparently 'Art and Architecture in Science'.

24 See letter from Denis L. Johnston, *Design* (1951), **32**, 30. Whether this was the lecture for which Lonsdale had first borrowed Megaw's drawings in unclear, but Lonsdale gave several such lunchtime lectures at University College London.

25 The members are listed at the back of the booklet produced by Mark Hartland Thomas to describe and celebrate the activities of the group, *The Souvenir Book of Crystal Designs: The Fascinating Story in Colour of the Festival Pattern Group*, London, HMSO/Council of Industrial Design, 1951.

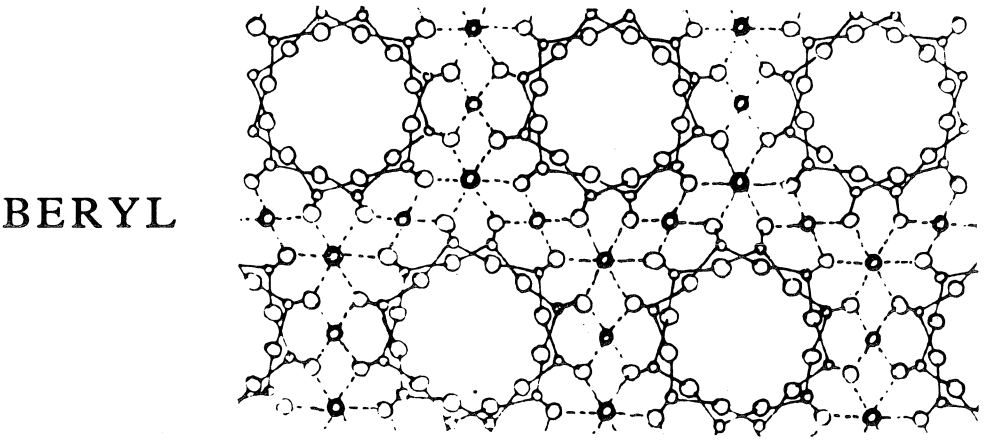



**Figure 2.** *Beryl*: the structure of beryl, first discovered by Sir Lawrence Bragg, and well adapted for the design of lace fabrics. It was also made into lampshades. As illustrated in the *Souvenir Book of Crystal Designs*, London, 1951, 1. Reproduced by kind permission of the Design Council/DHRC, University of Brighton.

the meetings. She supplied drawings and diagrams of the crystal patterns and the manufacturers were invited to use them as a basis for ornamental design in their goods. The patterns provided included boric acid, insulin, haemoglobin, beryl, mica, oxalic acid, afwillite and many more. Misha Black promised to use fabrics with crystal designs to furnish the Regatta restaurant, which he was responsible for designing, and indeed the crystal pattern textiles were used in several areas of the exhibition, as well as sold in the market in the normal way (see Figure 1).[26]

So here it appears there was a splendidly appropriate marriage of art and science, celebrating a notable area of British scientific achievement, and providing a source of inspiration to designers and manufacturers. Some scientists were certainly enthusiastic, Sir Lawrence Bragg for one. Indeed he claimed that he had realized as early as 1922 what a splendid idea this might be when he had first worked out the structure of argonite, and his wife was excited by it as a pattern for embroidery. He had tried to impress his friends in industry with the idea, hitherto without success, but as he wrote enthusiastically to his friend Kenneth Lee, chairman of the textile firm of Tootals, his tailor in Cambridge told him that ties decorated with crystal patterns were selling extremely well.[27] His wife, Alice Bragg, was even more delighted to be presented by one manufacturer with ten yards of lace based on the beryl pattern that Bragg himself had analysed, to make into an evening dress (see Figure 2).[28]

26 The souvenir element was of course fairly strong. See also the article by Helen Megaw in the *Architectural Review* (1951), **94**, 236–9, accompanied by illustrations of a number of fabrics and objects bearing crystal patterns.

27 W. L. Bragg to Sir Kenneth Lee, 17 May 1951, Royal Institution Archives, London, Bragg MS, 50B/159. Bragg in this letter states that Hartland Thomas heard Kathleen Lonsdale lecture at the Royal Institution, which is probably an error, though she did give a Friday Evening Discourse on 'Neutron Diffraction by Crystals' there in March 1949.

28 Royal Institution Archives, London, Bragg MS, 26 May 1951, 50B/161.

Designers, however, were not always quite so enthusiastic, particularly when it came to working with the crystal patterns. This was largely because Helen Megaw provided very precise diagrams, some with the crystals drawn in different ways, but designers found these too restricting. As a commentator in the *Architectural Review* stated sternly, 'they provide raw material for the artist... But the operative word is "raw"'.[29] It was perhaps feared that the patterns might be used as a short cut in the process of creating good designs. Hartland Thomas certainly sounded somewhat defensive when patterns were not quite like the original source. In retrospect many of those involved in the Festival dismissed the Festival Pattern Group as not very significant, among them Hugh Casson and Paul Reilly (later Director of the Council of Industrial Design).[30] Certainly the designs were not the commercial success that Hartland Thomas had hoped, despite the vogue for patterns based on molecules and atoms as well as crystals well into the 1950s.[31]

Clearly artists and designers expected to have complete freedom in using the patterns for inspiration or source material in whatever way might be most appropriate for the product in question. There was no reluctance to use ideas derived from scientific sources, because, as a contemporary commentator pointed out, these are absorbed peripherally, have no need for exact knowledge, and are picked up through the media.[32] The patterns had an attractive symmetry, and in many ways were ideally suited for materials produced by the latest mass-production techniques. Moreover designs drawn from science in this way were self-evidently essentially modern and abstract, with no reference to the traditional figurative motifs that were often derided at this time as the worst sort of imitative design. On the other hand, the designs were not too *modern*, as they were based on natural forms and therefore fell within the long hallowed tradition of 'truth to nature' within British design.[33] But the patterns revealed in sub-atomic nature were not the result of direct observation by the designer and had to be mediated by the scientist. For scientists, however, it was not a matter of simply using the patterns as part of a free-flowing creative process. The approach was quite different, and in the event raised issues relating to legitimacy, scientific reputation and ownership, and even the kind of knowledge represented in the use of the patterns. Furthermore Megaw's own creative processes when producing the patterns need to be understood and appreciated.

It was not a quick and easy process for Helen Megaw to produce a crystal diagram. It

29 Op. cit. (26), 236. Megaw's article was prefaced by an editorial piece in which this injunction appears.

30 Hugh Casson (1910–), Professor of Architecture at the Royal College of Art and President of the Royal Academy 1976–84; Paul Reilly, head of the Council of Industrial Design from 1960 to 1977. Interviews with both, conducted by Michael Cromarty, industrial design student, Teesside Polytechnic, took place in early 1985.

31 This hoped-for commercial success was clearly set out in the Festival Pattern Group meetings, which labelled all papers 'Secret', hoping to spring the design offensive on (unnamed) potential competitors. Hartland Thomas sent out highly charged pleas to the Group's members asking that the 'correspondence does not fall into unauthorised hands, by marking all envelopes "SECRET"' (*sic*); Megaw Papers AAD, 3/141-170. On the vogue for molecules and atoms, see Jackson, op. cit. (5), 86.

32 Marcel Brion, quoted in Jackson, op. cit. (5), 86–7.

33 This is nicely revealed in a letter from the sculptress, Barbara Hepworth to Marcus Brumwell, 'The main point seems to me to produce them as suggested in series – with their *proper* names – exactly as they really are. To me they are more beautiful than any *man-made* pattern.' Copy in Megaw's hand with letter from M. Brumwell, 15 March 1946, Megaw Papers AAD, 3/15-177.

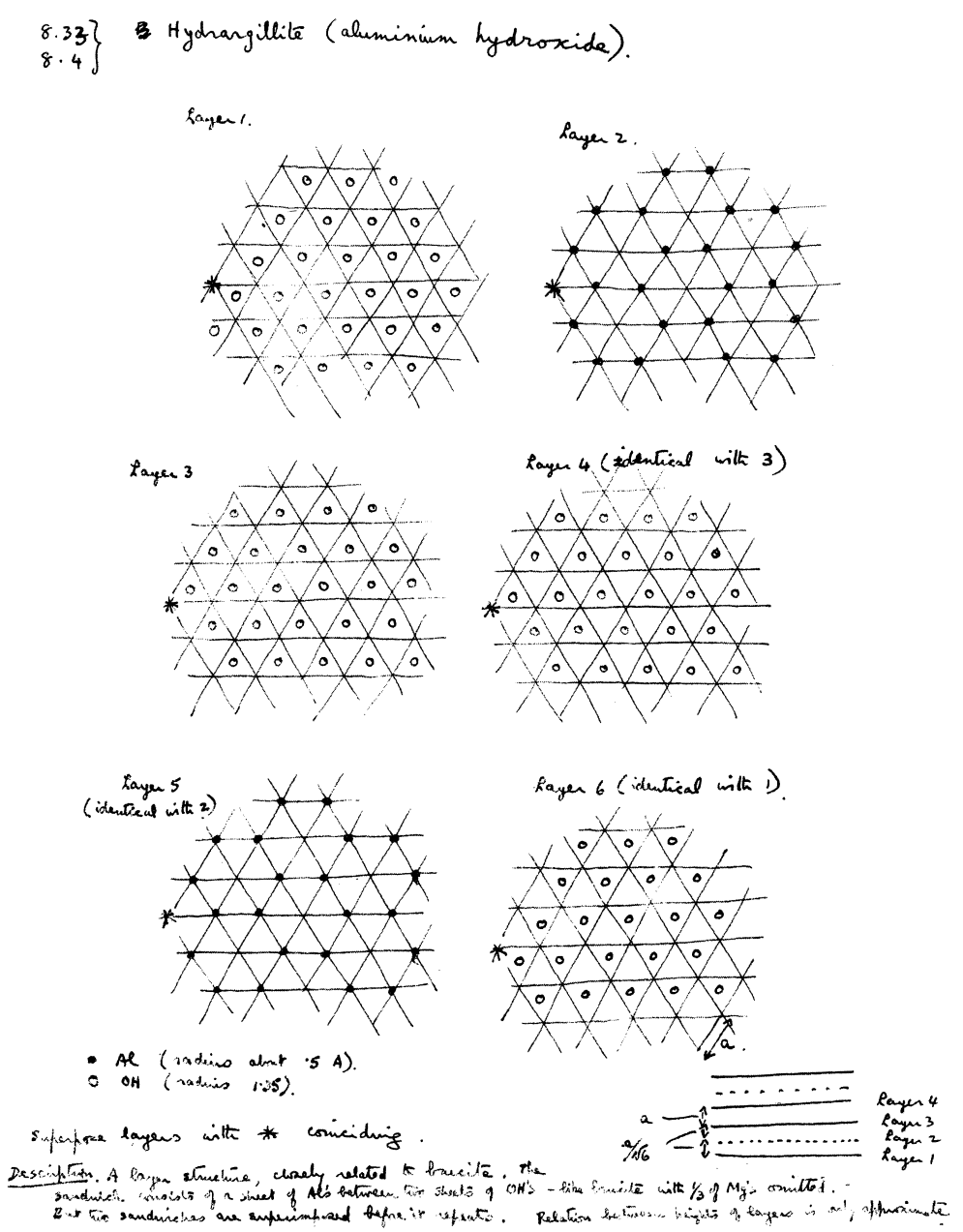



**Figure 3.** *Hydrargillite*: working drawing by Helen Megaw, showing the initial stages of drawing out each layer of the crystal and their relationship to each other, noting the radius of the atoms and how the structure repeated. Further drawings would be made to simplify the pattern into a characteristic form, or a number of variations, before submission to the Festival Pattern Group. For an example of the final version of hydrargillite, see the *Souvenir Book of Crystal Designs*, London, 1951, 9, 15. Drawing in Megaw Papers AAD, 3/490-1977; reproduced by courtesy of the Board of Trustees of the Victoria & Albert Museum Archive of Art and Design, London.

demanded skills of accuracy and interpretation of the highest order and indeed took many hours of painstaking work. The process was as follows. The three-dimensional structure of any substance had to be deduced from scientific data on the patterns of diffracted X-rays.[34] Working with the three-dimensional structure, Megaw drew out the molecules in separate layers on a sheet of paper. Having drawn each layer in the structure in plane, she then drew the structure as a section, as if cut through a sandwich. In both types of drawing it was important to make the angles and spaces between each atom absolutely accurate, which she did by giving the angles in degrees and the radius of atoms in ångstroms.[35] Ångstroms were hardly widely known or much used outside scientific research, and would not be familiar to designers or people working in the textile or ceramics industries, but indicate the procedures and measures that Megaw was normally used to working with. Once the molecule had been reduced from a complex three-dimensional shape to a flat pattern, or series of flat patterns seen from different directions, she drew the pattern as a repeat of each individual unit so that it covered an entire sheet of paper (see Figures 3 and 4). In other words the whole structure had to be represented, and it was not appropriate for a designer to play with a single molecule, which might result in a pattern where the packing of the molecules together might not be accurate.

Megaw spent a great deal of time experimenting with drawings of different crystal formations, discarding some as unsuitable and simplifying others. Some of the substances were obviously familiar through her own research, for others she used the diagrams and information contained in scientific journals, corresponding with the scientists concerned over the thorny question of copyright to the original diagrams as well as whether her drawings were an accurate representation.[36] She used different ways of representing the cell structure, using for example Patterson sections (which showed the distances between the major atoms of a crystal, rather like a contour map, see Figure 4), or Fourier projections (which also looked rather like a contour map).[37] She experimented with tracing a Patterson projection, leaving out most of the contours so that there was just an outline left, then retracing it and repeating the pattern by rotating it through 90° and reversing the image at the same time.[38] So the creative process for Megaw involved both constructing and simplifying the patterns derived from the scientific data, while at the same time maintaining the greatest degree of accuracy possible, yet also making a 'creative leap' in a scientific area

34 Megaw's article (op. cit. (26)) explains the process. The following discussion is based on an examination of Megaw's notes, working drawings and duplicates of patterns submitted to the Festival Pattern Group contained in the Megaw Papers AAD, 3/420 to 572, and 3/577 ro 693–1977.

35 An ångstrom is a hundred-millionth of a centimetre. Megaw was using a standard procedure for rendering a three-dimensional structure in two dimensions so that it could be reproduced for the pages of a scientific journal.

36 Copyright to the 'original' scientific description of the substance had to be negotiated with each scientist, who responded variously, especially when an element of secrecy was involved until the launch of the Festival.

37 A Fourier projection analyses into Fourier line wave functions the total electron density in a crystal and thus the amount of X-ray scattering produced by a crystal; Lawrence Bragg gives a clear description of such a projection in his lecture 'Crystallographic Research in the Cavendish Laboratory', reproduced in *Proceedings of the Royal Institution* (1950), **35**, 103–13, especially 105. Megaw tended to use Patterson projections more frequently, but both Fourier and Patterson projections produced nicely rounded amoebic shapes that accorded well with the curved, so-called 'organic' shapes of design trends at the time.

38 An example may be seen in the crystal structure of titanium boride, Megaw Papers AAD, 3/604 to 6-1977.

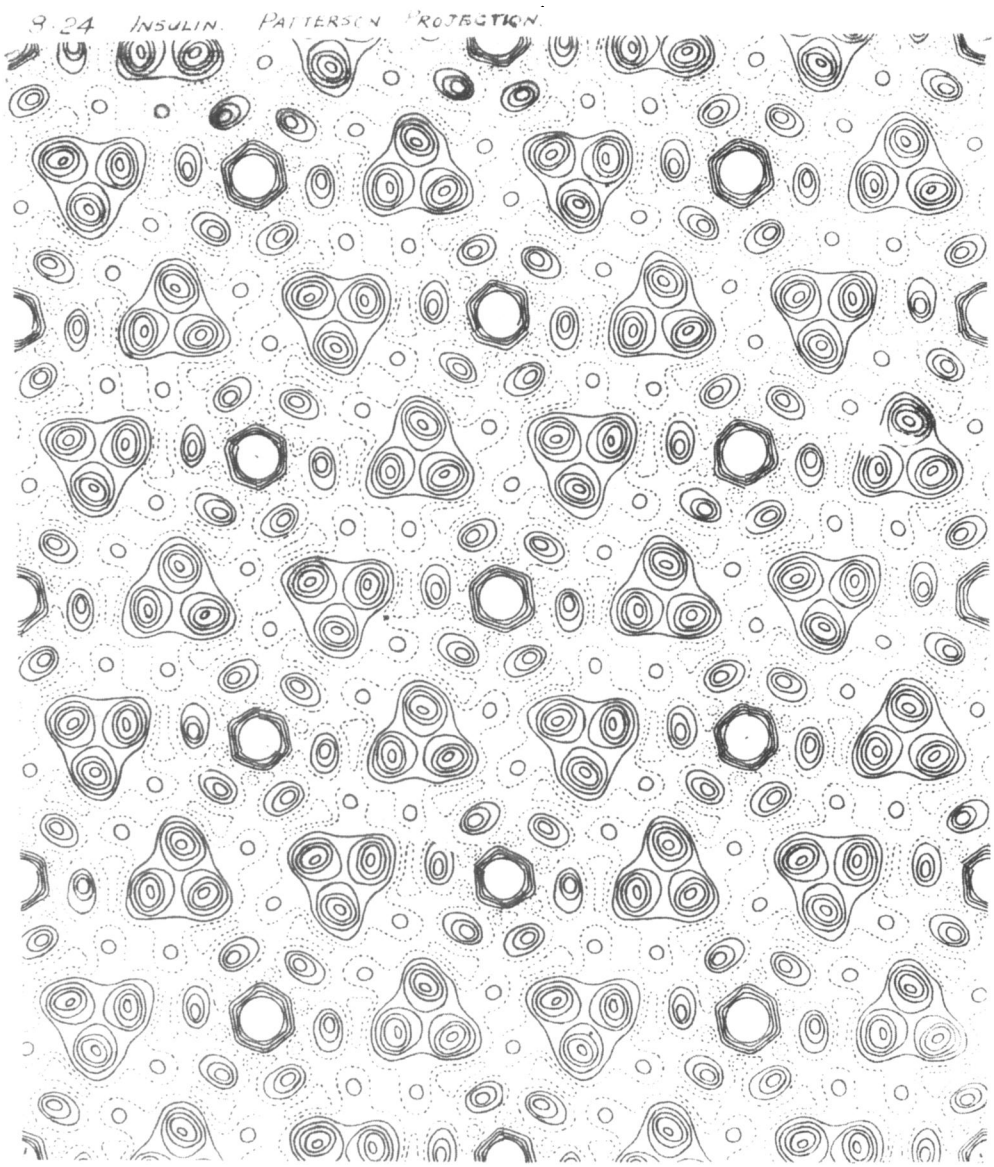



**Figure 4.** *Insulin*: Patterson projection showing the characteristic contour lines. This is typical of a finished pattern complete with repeats, submitted by Helen Megaw to the Festival Pattern Group. Insulin was a successful and widely used pattern, and versions were used for wallpaper, carpet, lace and leathercloth designs. Drawing in Megaw Papers AAD, 3/523-1977; reproduced by courtesy of the Board of Trustees of the Victoria & Albert Museum Archive of Art and Design, London.

where guesswork and trial and error experimentation were commonplace.[39] It was a complex process, embedded in scientific practice, though at the same time she was delighted by the beauty and symmetry of the patterns, as indeed were many crystallographers working at the time.[40]

When it came to transferring the beautiful patterns of crystallographic symmetry to everyday commodities, she was nevertheless prepared to accept some modification. Designers were allowed to modify the diagrams in ways that were suitable for the intended products, but only in ways that were legitimate within the framework of scientific knowledge (see Figure 5). She drew up a list of guidelines explaining the conventions used in the representation of crystal structures that stated explicitly what could or could not be done with the patterns:

> the same structure can be represented in a very large variety of ways ... It is legitimate to show only those features of the map which one desires to emphasize for a given purpose; but it is not legitimate to change their positions, or to put in things which are not there, or to put in some things of one kind and leave out others exactly similar.[41]

Most scientists were quite happy for their diagrams to be used, and there was a good deal of enthusiasm for the results and requests for samples, particularly for use in teaching, where it was felt they could well liven up a lecture to students. Some scientists, however, were less happy. C. W. Brindley of the University of Leeds wrote to Megaw about the accuracy of representation and what he clearly felt might be the possible effect on a scientific reputation:

> I think we ought to be properly safeguarded against any suggestion that the diagrams are scientifically correct. It ought to be stated rather explicitly in any handbook which refers to the origins of the designs that the originals have been treated in a very free and easy way. I feel sure you will sympathise with this and ensure that scientific results and reputations are not sacrificed.[42]

Absolute correctness and accuracy, strictly interpreted in whatever sphere it was applied to, underpinned the authority of an individual scientific reputation.

Another aspect of accuracy involved the name of each pattern. Naming the crystal pattern with its proper scientific name demonstrated its origin. Megaw certainly thought that each pattern should be given its correct name, just as William Morris patterns were called after their constituent flowers. 'I think the combination of a really attractive pattern with the assurance of scientific accuracy would win a lot of attention.'[43] At a lesser level,

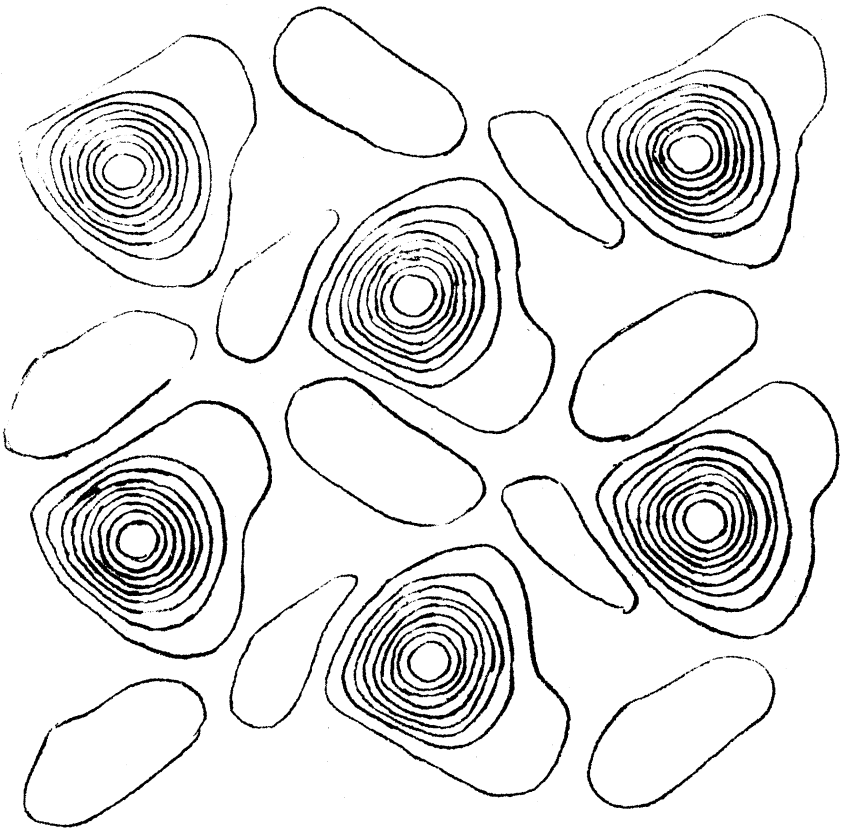
39 As Megaw wrote in her article, 'A good guess may take one straight to the answer, a bad guess wastes a lot of time before it is disproved', op. cit. (26), 239.

40 'I am constantly being impressed by the beauty of the designs which crop up in the course of the work without any attempt of the worker to secure anything more than clarity and accuracy', Megaw to Marcus Brumwell, 20 February [1946], Megaw Papers AAD, 3/12-1977. She was not alone in experimenting with such patterns. Professor The Svedborg (1884–1971), the Swedish Nobel prizewinner in chemistry, also designed around this time a series of textile patterns based on atomic, genetic and biological structures. I am grateful to Dr Ingrid Möring of Uppsala for this information.

41 Dr Megaw's 'Notes on the Crystal Structure Diagrams', p. 2 (data 12 January 1950), appended to minutes of meeting 16 December 1949 of Festival Pattern Group; Megaw Papers AAD, 3/125-170. The draft of her notes on the explanation of the conventions is found at 3/484-1977.

42 G. W. Brindley to H. Megaw, 19 February 1951, Megaw Papers AAD, 3/726-1977.

43 Megaw to Brumwell, 20 February [1946], Megaw Papers AAD, 3/12-1977. See also the comment by Barbara Hepworth cited in note 33.



(e)

Polythene (wanted for Science Exhibition)

Must be used as a continued repeat, and not an isolated motif. Some contours may be omitted, if done throughout, but not too many. Must remain as line diagram on uniform background

B.59 (e)

**Figure 5.** *Polythene*: one of five variations drawn up by Helen Megaw of the structure of polythene. Her notes for the guidance of designers read: 'Must be used as a continued repeat, and not an isolated motif. Some contours may be omitted, if done throughout, but not too many. Must remain as line diagram on uniform background'. Similar notes may be found on other drawings. Drawing in Megaw Papers AAD, 3/468-1977; reproduced by courtesy of the Board of Trustees of the Victoria & Albert Museum Archive of Art and Design, London.

the proper scientific names did not necessarily improve the chances of commercial success. Many were simply too much of a mouthful. Beryl and insulin were quite straightforward and probably familiar to most people, but hexamethylene diamine dihydrochloride, orthoclase, hydrargillite or pentaerythritol were not. Nevertheless a good many were used, and the *Souvenir Book of Crystal Designs* illustrates twenty-three crystal patterns with some additional variations.

Furthermore, it is arguable that retaining the names simply commodified the science from which they were derived, and affected their meaning in quite a different way. Science, which was potentially frightening, exciting and, above all, 'unknown' to the general public at this level, was reduced to surface ornament. The meaning of the original was thus dematerialized and rendered insignificant. While the names and designs might signify at one level an enthusiasm for science and faith in technological progress, the actual objects by their inertness, impotence and mere decorative value were in this context emptied of meaning. After all, it is hardly likely that one would think of nuclear research stations in the same moment as buying a Jacquard woven cloth called 'Harwell' to make curtains or counterpanes.[44] That is a different sort of consumer choice. The two belong to distant and rarely intersecting realms of experience.[45] And in any case, using scientific patterns as decorative motifs (and at one level they were simply that) inevitably exposed them to the ups and downs of fashionable trends in that particular consumer market. None the less, this is surely an intriguing example of an attempted arranged marriage between science and art. It presupposes underlying educational and informative intentions to the whole project, and a willingness on the part of the scientists, designers and manufacturers to work together. It failed, however, to appreciate the different conventions and creative practices used by each, the attitudes of scientists to the knowledge they worked with, and the perceived significance of accuracy as the underpinning authority of all scientific work.

## SCIENCE AND DISPLAY IN THE FESTIVAL

> Nor is science a strange and special kind of knowledge. Its underlying ideas are not difficult and not at all extraordinary. They can be understood and enjoyed by everyone. This is an exhibition for everyone, in which the ideas of science are shown as common knowledge.
>
> J. Bronowski[46]

Scientific patterns were certainly prominent among the fabrics and materials used in several of the displays and pavilions, and in this very visual sense were central to the exhibition design. I would now like to examine more generally how science was selected and displayed. This will be examined in three ways: first, how were the particular scientific

44 The fabric and wallpaper manufacturer, Warner's, developed a fabric named after the Atomic Energy Research Establishment at Harwell as part of their participation in the Festival Pattern Group; I am grateful to Mary Schoesser for this information.

45 Some oral evidence suggests that people remembered the patterns but did not connect them with the science as such, even when they had a scientific background.

46 J. Bronowski, *Exhibition of Science, South Kensington, a Guide to the Story it Tells*, London, 1951, 7. This quotation forms the second paragraph to Bronowski's opening chapter, 'The story the exhibition tells'.

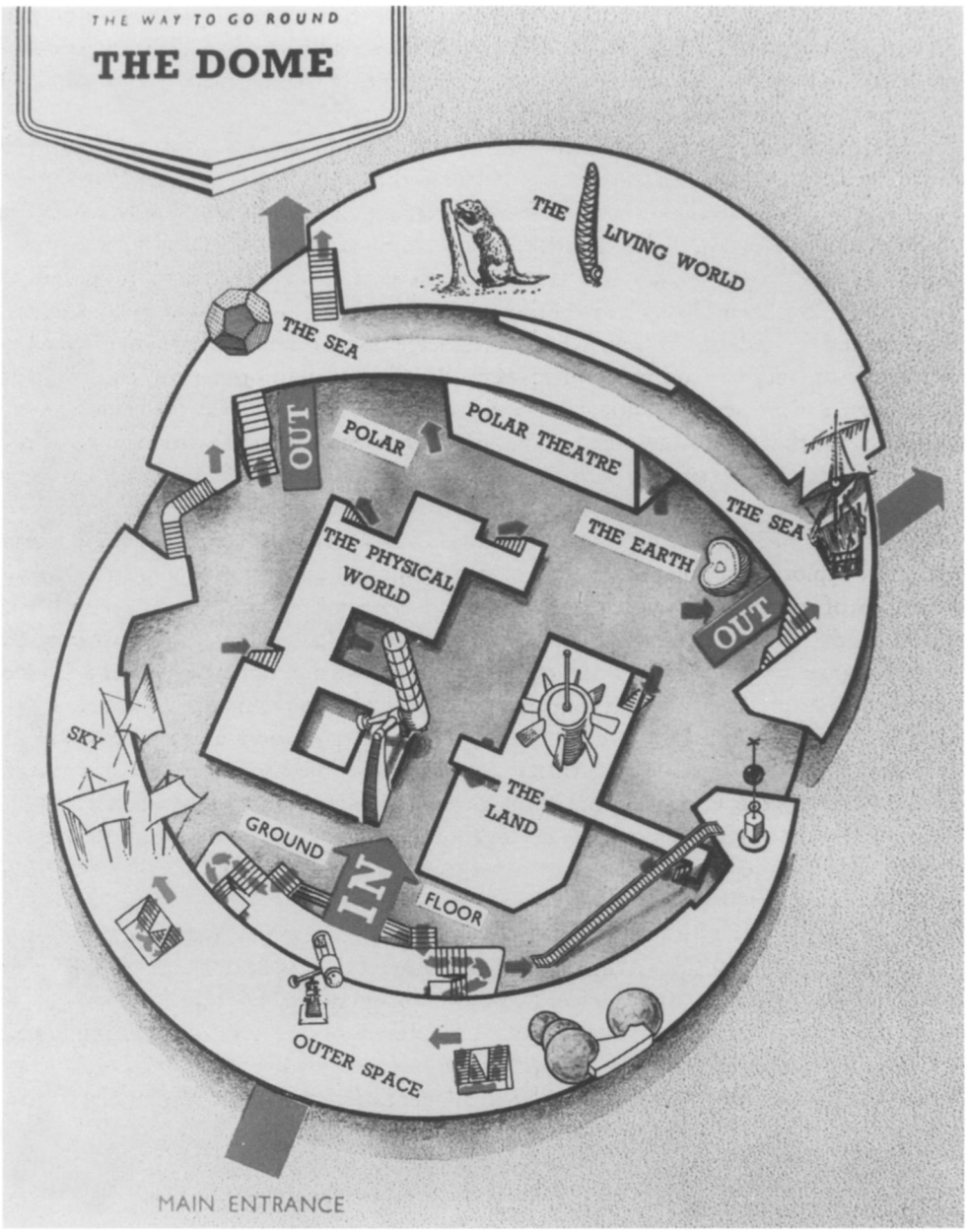



**Figure 6.** *Dome of Discovery*: plan in the South Bank Exhibition Guidebook, p. 40. The emphasis was on discovery and exploration, past and present, particularly those regions to which the British had always been lured 'where nature has been most extravagant or severe'. The Dome, designed by architect Ralph Tubbs, with its central open space and surrounding galleries, was one of the most memorable pavilions of the Festival. Reproduced by kind permission of the Design Council/DHRC, University of Brighton.

themes chosen and developed; secondly, what were the perceived concerns in creating displays to illustrate the themes, and finally, what techniques were used. It is then possible to consider the success of the Festival in presenting science to the general public and some of the problematic relations with the broader social context.

In Ian Cox's view, it was the Science Council that had the greater involvement in the development of the thematic story for the whole exhibition. It was certainly Cox himself who by July 1948 had worked out the basic scheme, which was immediately accepted.[47] One might therefore argue that the theme as it emerged was a reflection of the view of science, its role in British history and British society, that was held by the distinguished scientists on the Council and the various advisory panels working under Cox's general direction and, indeed, inspiration. The general theme rested on the 'twin horns' of the land and people of Britain, and linking them were 'British contributions to civilisation' in the form above all of scientific and technological advances.[48] Science was embedded in each area of the South Bank Exhibition as well as having its own special exhibition at the Science Museum in South Kensington. On the South Bank the Dome of Discovery of course provided the central space – Cox saw it as linking the upstream and downstream circuits – for displaying British scientific achievements. Displays in the Dome covered, in brief, terrestrial exploration, polar discoveries, navigation and oceanography, the structure and behaviour of matter, the weather and ionospheric research, astronomy and outer space, and finally the living world, biological research and its results (see Figure 6). However, each field of science was also deliberately identified and included in other parts of the Festival. Geology, for example, featured in three different sections, the Land of Britain, the Natural Resources display and the Seaside pavilion. Beyond these, 'modern methods of geological surveying, seismography, isostasy, vulcanicity, the age of the earth, and the formation of economic minerals formed part of the displays in the "Land" section of the Dome of Discovery'.[49] Metallurgy appeared in four different pavilions – 'Natural Resources', 'Power and Production', 'Transport' and 'Sea and Ships'. Science therefore was omnipresent, found in almost every pavilion.

The emphasis was obviously on discovery, notably in the South Bank Exhibition. It focused above all on the British contribution to stories of discovery, and emphasized British leadership in particular areas of science and technology, not without justification in areas such as radioastronomy or crystallography. Furthermore, the science and technologies exhibited were 'the story of British contributions to world civilization in the arts of peace' and in true 'swords into ploughshares' spirit, all mention of the arts of war was excluded.[50]

47 I. Cox, 'Contribution of the Science Directorate to the Festival of Britain 1951', PRO, WORKS 25/50, 4. This was formally adopted in August 1948 by the Executive Committee and approved in September by the Festival Council. Cox's key role in developing the theme seems to have gone unremarked, despite his own assertion of it in Banham and Hillier, op. cit. (4), 63.

48 Science Museum Archive, London, FOB/Press/5/50, p. 1; a series of press releases emanated from the Festival Office in a well-organized press campaign.

49 'Placing of the Main Scientific Subjects in the South Bank Exhibition', Science Museum Archive, London, FOB/Press/5/50, Appendix 1, 3. The names of the sections in this 1950 press release do not precisely correspond with the names finally given to each pavilion, but identification is relatively straightforward.

50 Cox, op. cit. (8), 8. It should, however, be remembered that these years were also those of the Korean War, and journals at the time, such as the *Illustrated London News*, interleaved their accounts of the Festival and its preparations with reports from the front and news of the retreat from the Imjin River.

Beyond simply selecting the areas of science to be displayed, the exhibition organizers soon found themselves facing a number of problems in creating displays to illustrate the scientific themes. These focused around four main concerns. First, the organizers were most concerned that the overall message (the British contribution to discovery) should come through loud and clear, and not be detracted from by dividing science and technology up into separate exhibitions on different sites. The focus therefore was on the South Bank, and all other exhibitions were designed to support and enhance the message of the South Bank, not detract from it. Therefore space for the display of the more fundamental aspects of science, which might spoil the balance of the South Bank Exhibition, was removed to South Kensington. The approach overall to both the planning and design of the exhibition was holistic. This is most clearly reflected in the common graphic format, colour-coded guides, approach to layout, the use of scientific imagery, and indeed the Festival Pattern Group, which were all part of the Modernist ideology that suffused the architecture and design of the Festival.[51] It was not, however, always easy to maintain this unity of approach when the researchers and design assistants came from very different backgrounds and 'cultures'. On one occasion the Director of the Science Museum wrote complaining to Cox that some researchers 'have shown an almost total unfamiliarity with the elements of the subjects with which they are dealing: thus one of your young ladies, I am told, asked the question "What is a searchlight?"' There must be some exaggeration here, for it seems wholly implausible that any adult should not know what a searchlight was in 1951, but Cox had to write apologizing for 'inexperienced personnel bothering staff'.[52]

A second concern was that where the British story of discovery was exhibited, 'Great care [should be exercised] in the selection of subjects to avoid making or implying claims for British leadership where these could reasonably be questioned by overseas visitors.'[53] On these grounds it was decided to exclude the subject of oil. This brought protests from the Institute of Petroleum and the Raw Materials Advisory Council. A compromise was agreed on: there should be no sequence of displays solely devoted to oil prospecting as such, but where references could be made in other sections this would be done. Moreover, as Sir Frank Smith observed, relations between British and American oil companies were very cordial and co-operative at present, and 'it would be a great mistake to prejudice them by appearance to claim more for British scientific enterprise than is really due to it'.[54] A judicious appreciation of scientific priority went hand in hand with a sense of commercial reality and the need to maintain friendly trading relations. The two major companies, Anglo-Iranian and Shell in the meantime organized a separate exhibition on the petroleum

51 Note the carefully thought out approach to design, seen for example in the exhibition guidebooks, colour coded for different sites, and the general thrust of the layout and typography towards clarity and easy communication. Similarly, scientific imagery ran through much of the display design, from Festival Pattern Group fabrics and carpets to atomic lighting structures – one over 600 feet long was used in the Science Museum. Many of the exhibition architects and designers had belonged to the pre-war Mars Group, which brought together those most interested in the new ideas emanating from the Continent, in particular from CIAM (the Congrès Internationale d'Architecture Moderne).

52 F. Sherwood Taylor to Cox, 12 October 1950, and Cox reply 18 October 1950, Science Museum Archive, London, 8390/21.

53 Minutes of Council for Science and Technology, 13 October 1948 meeting, PRO, WORKS 25/50/A5/F1.

54 Minutes, op. cit. (53), 14 December 1949 meeting.

industry at the University of Cambridge, which was in any case one of their main recruiting centres.[55] In the event the organizers were perhaps prescient, since the Iranian oil crisis broke during the Festival, when the Iranian Prime Minister, Mossadeq, nationalized the Anglo-Iranian Oil Company.

A third and related concern focused on whether the British contribution to a particular field of enquiry was indeed particularly overwhelming. In many cases, after all, it was difficult to attribute progress entirely to the efforts of one country. Polar exploration was one such case. It was decided by the Cartography Advisory Panel to tell the stories of the Arctic and Antarctic separately. The section on Antarctica would start by outlining the story of discovery and gradual definition of the continent by successive sightings and voyages. In date order these were reduced to the voyages by Cook, Bellingshausen, Biscoe, Ross, Larsen and Discovery II. The Panel then came to a conclusion and 'It was *agreed* that greater force will be given to these early British achievements if the voyages of Bellingshausen (Russia) and Larsen (Norway) are *not* denied mention' (underlining in original).[56] The Panel further decided to have a chart showing the lines of the voyages in diminishing roughly concentric circles. They were, however, concerned that full justice would not be done to the British achievement, 'because this, in later years, had not been so much a matter of "first sightings" as of detailed exploration and mapping'.[57] Despite these misgivings, after due consideration of the problem, 'The meeting *recognised* [*sic*], however that the Track Chart of ships entering the Antarctic region when viewed together certainly showed how great had been the British effort in this region.'[58] Foreign achievements could therefore be included if they underlined those by British explorers, and the design of exhibits reinforced the message. The remaining two sections on Antarctica were confined to the exploration of the Ross Sea and continuing contemporary scientific work, the latter to be emphasized by arranging to receive 'live' weather reports from the meteorological station in Graham Land. Stories were therefore extremely carefully selected and edited, and the type of display chosen so as to underpin the theme.

The final concern not surprisingly was that *all* the displays should be communicable to a lay public. As the caption by Bronowski at the head of this section emphasizes, this was in part to demystify science as being difficult and inaccessible to the general public. However, at the same time, the organizers were most concerned that all descriptions and captions should be strictly accurate in a scientific sense, which recalls the problem discussed above with regard to the Festival Pattern Group. To communicate easily and maintain strict accuracy at the same time was not always easy to achieve. For example, various mathematical models were included in the Dome of Discovery, because models were helpful in visualizing problems and enabling the viewer to follow the analysis. One of Cox's subordinates, Brigadier J. L. P. Macnair, checked the accuracy of the models' descriptions with the mathematical instruments curator at the Science Museum. There

55 *An Exhibition of the Petroleum Industry, 1951*, Cambridge, 16–28 July, booklet produced by Anglo-Iranian Oil Co. Ltd and the Shell Petroleum Co. Ltd.

56 Minutes of the Cartography Advisory Panel, 20 December 1948, PRO, WORKS 25/50/A5/G3, minute no. 5.

57 Minutes, op. cit. (56), minute no. 7.

58 Minutes, op. cit. (56), minute no. 8.

ensued some correspondence about whether the cylinder in one model was 'inclined to the vertical' or whether it was 'a vertical cylinder'. Eventually an improved description was agreed upon and Macnair made the alterations as suggested, adding wryly 'I think [the description] "a surface for which the curve is a locus of cuspidal points" is going to land us in difficulties with the editors.'[59] Certainly there were great efforts to achieve accuracy though some scientific visitors later remembered that some of the labels were not entirely factually correct.[60]

If accuracy and precision were felt to be the keystones of a scientific approach, exhibitions were above all about communication to a lay public, to what was in fact a diverse set of audiences. Sensitivity to the importance of selecting the most appropriate display technique has already been seen with regard to the Antarctic display. But, overall, everyone involved in the organization of the Festival was determined to ensure that it was better than what had been done elsewhere. On the one hand, exhibits should not be mere stunts, but they should not be short on appeal to a lay public. Two Festival officers were sent to the Stockholm Exhibition of 1949, and another to the Palais de la Découverte, a relic of the 1937 Paris Exhibition. A long report was written on the latter with the strong recommendation that the scientific officers and the designers should visit it.[61] Certainly the Festival used virtually every technique available at the time: models, murals, charts, films, moving objects, buttons to push, sculptures, photographs, text panels, live radio transmissions, live exhibits (including a team of husky dogs who stole the Antarctic 'show' in the Dome of Discovery) and so on. Beyond the abundant variety, some deliberate policies may be discerned.

The first was a conscious decision to embrace commercial techniques. This was not altogether surprising given the use of such techniques in the extremely successful government propaganda and information put out by the Central Office of Information during and after the war. Misha Black in particular seems to have been regarded as an authority in this respect, no doubt because he was himself an ex-Ministry of Information architect and designer. A pamphlet entitled *Display: Design and Presentation* (April 1949) containing an article by Black was circulated round the Festival officers. The article in question contained the following rubric:

> Each problem requires its own special solution and the designer must be ready to use every trick and device of the advertising man, the film director and the professional illusionist to shout or whisper (as the subject may require) his message at the unsuspecting visitor.[62]

As Black emphasized, the general design and form 'subconsciously affect the visitors... but they were no more consciously conscious of the skill and ingenuity of the exhibition designers'.[63] The design of exhibits should not be overly obvious to the visitor, not too

59 Correspondence between Dr F. Calvert and Brigadier J. L. P. Macnair, 31 January to 19 February 1951, Science Museum Archive, London, 8390/42/1–2.

60 Sir Andrew Huxley in conversation with the author, April 1995.

61 Report by A. R. Michaelis, 14 June 1949, PRO, WORKS 25/50/A5/F2.

62 Black's article was highlighted by a note on the circulation list; PRO, WORKS 25/19/A1-E1, 19. Black also edited the standard text on exhibition design first published in 1950, *Exhibition Design*, London, 1950.

63 Black, PRO, WORKS 25/19/A1-E1, 19.

slick, but on the other hand should avoid following the same old formula. Indeed, beyond commercial techniques, there was a new appreciation among the Festival officers of the importance of techniques used in the entertainments industry.[64] Some of the techniques seem to have been adopted with little alteration. Each display had a 'script', and the 'script-writers'' text was broken up like a play with captions, diagrams and general stage directions. Films were used. Originally it was hoped to have six small cinemas in the basement of the Science Museum, but cuts in funds meant that this was reduced to one. The Science Exhibition had a 'Stop Press' section, featuring the latest on 'The Problem of Life', 'The Computer Machine', 'Cosmic Rays', 'The Universe', and so on. This was very much the world of mass communication and mass entertainment, and drew on the topics regularly featured in comics and 'B' movies. Children's magazines such as *Collins*, carried extensive articles about the Festival as well as their usual diet of stories such as 'The black moose of the swamp'.[65] In the end, though visually stimulating and thoroughly enjoyable, the contemporary judgement was that the result was too wordy.

However, there was also another aspect to the approach to display, which fitted in neatly with the emphasis on Britishness and on Festival fun. Science was a domain of mystery, wonder and excitement. However could one achieve a sense of an 'enchanted world'? The answer lay in that English classic of where things are not what they seem to be, *Alice in Wonderland*, put together with an up-to-date assessment of visitor behaviour. This was especially apparent in the South Kensington Exhibition. One proposal, emanating from the German-born Scottish physicist Max Born (1882–1970), was to create a Newtonian-Einstein house, which would 'introduce visitors to an enchanted world, in which people would stand or sit, not on a flat floor, but on a curved wall; in which their weight would change as they walk about; and in which objects thrown or rolled on the floor would travel in peculiar trajectories'.[66] The 'house' would have a fantastic and futuristic exterior, containing a revolving chamber with a parabolic floor. It could be used for scientific experiments, as well as giving the public the 'excitement of a turn surpassing any fun fair'. Unfortunately the project was never realized, though experiments were carried out in a garage using a turntable and a fairground roundabout. When consulted, the Director of the RAF Institute of Aviation Medicine reckoned that Coriolis forces and vertigo would be a great problem and people could only spend a maximum of three minutes in it and, in addition, the Director of the Science Museum refused to take it on after the Festival as a permanent adjunct to the Museum.[67]

The Alice in Wonderland theme was, however, a prominent feature of the way that the five rooms forming the entrance gallery to the Science Exhibition were organized. Here the

64 As Cox wrote in his summary of the science exhibition plans, 'The preparation of a science exhibition along such novel lines is in the hands of a small central staff of highly trained scientists, working in collaboration with artists and specialists from the entertainments industry', 19 January 1950, PRO, WORKS 25/40/A5/A6.

65 *Collins Magazine for Boys and Girls*, May 1951.

66 Appendix IV to Director's Report to the Council of Science and Technology, 20 July 1949, PRO, WORKS 25/50/A5/F2.

67 Memo by Cox, 15 May 1950, op. cit. (66). Perhaps the experimental fairground roundabout was the same as the one actually used in the Battersea Pleasure Gardens, where, as the novelist Penelope Lively recalled, 'spectators could watch the entrancing exhibition of women desperately trying to hold down their flying skirts as they were whirled around'; reported in *The Times*, 1 March 1996, 31.

visitors entered a new world and 'shrank' in size as they penetrated further and further into the heart of matter. As Bronowski wrote in the *Guide*:

> Going through these rooms you seem to shrink like Alice in Wonderland, and the things round you seem to grow larger and larger. There are pencil and paper in the first room. Now you find yourself apparently shrinking, first to the size of the pencil, and then to the thickness of the paper; you see that the pencil lead slides off in layers as it writes. Another step, another thousand times smaller, and you see the structure of the graphite crystals which make up the pencil lead. And then a last step, you are ten thousand million times smaller than you began, and now you see into the atoms themselves.[68]

As the exhibits became larger and larger, the visitor would become progressively 'acclimatized' to the scale of the structures. Changes in acoustics, temperature and smells would enhance their impression of penetrating a new and different world. Light would gradually decrease until there was none except from the nuclei and electron clouds. The boundaries of the rooms – walls, ceilings, floors – would progressively disappear. Finally the visitor would walk through the electron orbits of an atom.[69] It was by means of such devices that the visitor was raised to a different level of reality, that the appeal to the imagination was made, so that one could make the leap to 'see' and therefore 'believe' what this invisible world was like and how it was structured. It is difficult of course to ascertain whether visitors did in practice feel like Alice and appreciate this journey into wonderland, and whether this depended on already having some scientific knowledge or bent, but certainly the organizers felt that the atmosphere created was appealing and successful.[70]

## CONCLUSION

The Festival of Britain has much to offer the historian of science concerned with the role of science in culture, and some tentative conclusions may be drawn. The activities of the Festival Pattern Group, the pervasive presence of science and technology, and the care taken over display certainly reveal a more important role than has hitherto been accorded to those involved with the selection and presentation of science. Indeed in 1951 there was rather less evidence than might be expected, in the light of subsequent debate, of a cultural division between the humanities and the sciences. General optimism about science and

68 Bronowski, op. cit. (46), 7–9.

69 These changes are clearly laid out by Ian Cox in a detailed Appendix II, dated 6 December 1949, to the Agenda of the third meeting of the Council for Science and Technology on the Science Exhibition at South Kensington, Science Museum Archive, London, 8390 (Box general papers), 2–3.

70 The target audience was 'that part of the general public with a predisposition to be interested in scientific matters', Cox, op. cit. (69), 2. Bronowski's final text for the printed Guidebook was considerably simplified and made much more accessible than the original script. There is some evidence that those with no knowledge but an intelligent interest in science found the Science Exhibition exciting and interesting. One such visitor recalled the soft booming (recorded) voice at the entrance, the rotating piece of graphite drawing a broken circle, the increasing darkness as one proceeded, and felt that it gave her a real thrill and sense of excitement; Verna Metcalfe in conversation with the author, September 1996. Cox's final Report noted the 'pleased surprise felt by our visitors from abroad on finding such an atmosphere in an exhibition of science', Cox, final Report, op. cit. (11), 15.

technology was widespread.[71] At the very least the Festival was an example of the cultures of science and the cultures of design working together. Many of those involved seem to have been pretty much at home in both literary and scientific spheres. Bronowski was a case in point; while not a pure research scientist in an academic sense, he combined a career in the government scientific service with numerous literary and lecturing activities. His first publication was a book about the relations of science and poetry, he published a respected book about William Blake in 1944, he wrote radio plays and won a prize for one in 1951.[72] The same year he published *The Common Sense of Science*, with its familiar themes working through the history of science – cause, chance and order.[73] He certainly feared that science and 'our social habits' were out of step, but did not see the remedy as unduly difficult. It was not unusual either to find the odd literary man earning a little extra in the years of post-war austerity by writing about science and technology. Compton Mackenzie wrote a paean to the gas industry called *The Vital Flame* at the behest of the British Gas Council in 1947.[74]

So why has the role of science in the Festival been so underplayed in the historical record? One may point certainly to two major factors. The first concerns political opposition, and it is well known that the incoming Conservative government of September 1951 was generally hostile to the Festival and the vision of a modern socialist welfare state that it represented. The Festival was rapidly dismantled, and in succeeding international exhibitions, such as Brussels in 1958, while science continued to represent the face of modernity in Britain, it was at the same time juxtaposed with ephemeral products and backward looking heritage design.[75] The effects of such a juxtaposition remain to be explored. The second factor relates to the well-known 'two cultures' debate. Indeed, C. P. Snow's diatribe against the ignorant arrogance of literary intellectuals hinders our ability to see the early 1950s as anything other than the run-up to an unbridgeable cultural

71 This optimism was in great measure encouraged by scientists themselves, despite their simultaneous charges of neglect and lack of investment in science; see D. Edgerton, 'British scientific intellectuals and the relations of science, technology and war', in *National Military Establishments and the Advancement of Science and Technology* (ed. P. Forman and J. M. Sanchez-Ron), Dordrecht, 1996, 1–35.

72 The *DNB* lists Bronowski (1908–74) as 'mathematician, poet and humanist'. Trained in mathematics at Cambridge, Bronowski's wartime work related to developing operational research methods. From 1946 to 1950 he worked on statistics relating to the economics of building and other industries for the Ministry of Works, and in 1950 became Director of the Coal Research Establishment with the National Coal Board. The books referred to here were *The Poet's Defence* (Cambridge, 1939), and *William Blake, a Man Without a Mask* (London, 1944). He won the Italia Prize for *The Face of Violence* (London, 1951).

73 First published 1951, reprinted eight times since, and still available. Bronowski continued to be a prolific author, and went on to become a favourite 'Brains Trust' panellist and presenter of science to the public, notably with the success of the television series and accompanying book, *The Ascent of Man*, London, 1973.

74 The penultimate paragraph included the following glowing tribute to the spirit of the gas industry: 'I prefer to look for it [an explanation of the enthusiasm] partly in the acute sense of social service which the manufacture of gas fosters, partly in the excitement of the discovery that an industry which seemed static for so long is now as dynamic as any in the country, and partly in the crusading spirit begotten by the continuously growing opportunities to persuade the public that the flame is still as vital as it ever was in spite of electricity's advance, and now the promise of harnessing atomic energy'; *The Vital Flame*, London, 1947, 80.

75 The design aspects of this are discussed in J. M. Woodham, 'Managing British design reform I: fresh perspectives on the early years of the Council of Industrial Design', *Journal of Design History* (1996), **9**, 55–65.

gulf. And, as Stefan Collini has pointed out in his introduction to yet another reprinting of Snow's text, Snow's thinking was rooted in the antagonisms of Cambridge in the 1930s.[76] Neither wholly reliable as a scientist nor immune from criticism as a novelist, Snow did, however, manage to touch a nerve that has twitched restlessly ever since. The crucial issue of course for Snow was the backwardness of an educational system that concentrated on classics and literature rather than science. Yet there were extensive moves in the 1950s to increase science education in the grammar and public schools with a view to training a new 'proconsular' élite – captains of industry, men of affairs and Whitehall mandarins.[77] Snow was in effect contributing to declinist myths that, as Edgerton has shown, have proved damagingly seductive and long lived.[78] By contrast, Festival science was optimistic, technocratic in spirit and, moreover, was 'official' science, selected and put together by some of the most eminent scientists in the country. It looked to a 'diffusion' model, to attempt to spread scientific knowledge as widely as possible.[79] However, whether it encouraged investment in new technologies, and in bringing up to date the industrial base that underpinned the welfare state, was quite another matter and one outside the scope of this paper.

Did its message get across and how was it received? There were of course different audiences with different outlooks and agendas, and perhaps the key response depended on whether one was a scientist or not. David Lodge's sixteen-year-old hero in his semi-autobiographical novel, *Out of the Shelter*, had initially been sceptical, but when he finally visited the exhibition with a school party, 'all his scepticism and scorn had been swept away by a rush of wonder and delight'.[80] No doubt the pavilions, the displays and the general ambience created by the Festival worked their magic similarly on many people. Suffice it to say that all fields of endeavour employ the visual languages available to them at the time. However, ten years later, Misha Black was less optimistic and of the opinion that the various scientific displays 'probed the limits of exhibition technique for scientific exposition; their partial failure was a contribution towards a clearer appreciation of the problem of communication between the scientist and the lay mind'.[81] This muted optimism provides a marked contrast to the enthusiasm current at the time of the Festival, and perhaps reflects as much as anything else the impact of the two cultures debate.

76 C. P. Snow, *The Two Cultures*, with Introduction by Stefan Collini, Cambridge, 1993.

77 Gary McCullock, 'A technocratic vision: the ideology of school science reform in Britain in the 1950s', *Social Studies of Science* (1988), **18**, 703–24.

78 See Edgerton, op. cit. (6), 19.

79 Indeed a large number of exhibits and a large quantity of display materials were earmarked for schools and museums after the Festival, especially those exhibits that helped visitors to understand 'how we know' and be entranced by the beauty and excitement of science.

80 David Lodge, *Out of the Shelter*, London, 1970/86, 132–3. See also his Epilogue written in 1984, p. 278.

81 *Design* (1961), **149**, 51.